PipelineML

What is PipelineML and What Can It Do For Me?

Discovering PipelineML
White Paper Series

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PipelineML

About This Document

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Key Phrases

PipelineML, PipelineML, oil and gas, pipeline, data exchange, data interchange, open data interchange standard, data sharing, operators, service providers, automated data quality testing and reporting

Knowledge Prerequisites

- Basic technical knowledge required

- No knowledge of PipelineML required [introductory content]

Intended Audience

Individual Roles

- ⊕ Executives
- ⊕ Management
- ⊕ Operations
- ⊖ Technical

Companies

- ⊕ Pipeline Operators
- ⊕ Service Providers
- ⊕ Software Vendors
- ⊕ Regulatory Agencies
- ⊕ Emergency Responders

Intended Outcome

- ⊕ Understand the value proposition of PipelineML

- ⊕ Learn how PipelineML is designed to facilitate new business opportunities

- ⊕ Learn how PipelineML helps people move information quickly and easily between disparate platforms, systems, applications, and devices without the need for people to interpret its meaning

- ⊕ Discover how PipelineML can benefit your company

Introduction to PipelineML

S uccess in today's competitive oil and gas market requires companies to provide up-to-date asset information to decision-makers in a timely manner. Bottlenecks in the flow of information translate into lost business opportunities. Those who move information the fastest and most efficiently gain competitive advantage.

PipelineML is a free OGC Standards based solution designed to help oil and gas stakeholders move information quickly and easily. PipelineML is a data interchange standard designed to simplify and expedite the process of sharing information. It enables you to get data out of your system and into a universal format that can be consumed into any other system.

Once you export asset information as PipelineML, it can be sent as a single file or streamed over the internet—whether one-to-one or broadcast to many parties at the same time. PipelineML files also can be archived as a moment-in-time snapshot of asset information for use in machine learning and other analytic tools.

PipelineML is completely independent of:

☑ Information Systems (Software, Data Models)

☑ Platforms (Operating Systems like Unix, Apple iOS and Windows)

☑ Devices (Mobile, Tablet, Desktop, etc.)

Data Interchange Examples

To understand how PipelineML solves key industry challenges, let's first consider who needs to exchange information to keep product safely flowing through pipelines:

Between Pipeline Operators and:

Internal Business Units

To keep product flowing safely, numerous business units within an operator must continually exchange information. This includes such business units as system design, commercial, construction, field operations, land administration, GIS, SCADA, facility management, risk assessment, integrity management, regulatory compliance, etc.

Service Providers

Pipeline operators need to provide information to their service providers as well as to receive information back from them at completion of work. This includes such service providers as construction management companies, survey and mapping companies, pipeline rehab vendors, pressure testing companies, ILI pigging vendors, alignment sheet vendors, etc.

Regulatory Agencies

Pipeline operators are required to submit up-to-date information about assets being managed to various regulatory agencies such as PHMSA, PPTS, TRRC, etc.

Emergency Responders

Pipeline operators have the opportunity to share information about operated assets to emergency responders.

Other Pipeline Operators

Pipeline Operators frequently exchange pipeline data during acquisitions, divestitures and transfer of operating responsibilities.

What Information Can Be Described in PipelineML

The kind of information you can put in a PipelineML data package includes: pipeline system information, collections of components, individual components, with a full complement of attributes including precise geographic location. The current scope of PipelineML includes the following components:

▪ Casing	▪ Elbow	▪ LinePipe	▪ Reducer	▪ Tee
▪ Coating	▪ Flange	▪ Meter	▪ Sleeve	▪ Valve
▪ Compressor	▪ LauncherReceiver	▪ PipeConnector	▪ Tap	▪

Virtually every type of information that can be included in PipelineML data package is optional so you have the flexibility to include exactly what you want to provide and nothing else. This allows you to store a single record in a PipelineML file that is tiny (Bytes) or millions of records that is massive (Gigabytes). This means, for example, that you can create PipelineML data packages that contain the following:

- A pipeline system summary including the location of its centerline

- Package containing the locations and attributes of all welds on a section of pipe

- A small segment of a pipeline (of any size) and its attributes

- An inventory of all known individual components that are located in a pipeline system or segment (with or without weld information)

- A single component such as a meter, valve, compressor, etc. along with its attributes and geospatial location.

Sample PipelineML File

To help demystify what a PipelineML data package is, take a look at the following example. Some of the technical details have been removed from the heading of the file to make it easier to read. This PipelineML file contains only a single valve, its geographic location, and some basic attributes:

```xml
<PMLDataset>
    <PipelineML:dateTime>2018-11-07</PipelineML:dateTime>
    <PipelineML:PMLVersion>1.0</PipelineML:PMLVersion>
    <PipelineML:defaultCRS>WGS84 (EPSG:4326)</PipelineML:defaultCRS>
    <PipelineML:Valve gml:id="idB17432A4-1B90-DF11-9C20-0026552185C4">
        <PipelineML:code>8583</PipelineML:code>
        <PipelineML:installDate>2013-03-27</PipelineML:installDate>
        <PipelineML:location><gml:LineString xmlns="http://www.opengis.net/gml"><gml:posList>-92.71162007 32.6621386 -92.71161452 32.66214162</gml:posList></gml:LineString></PipelineML:location>
        <PipelineML:valveManufacturer xlink:title="TD Williamson, Inc."/>
        <PipelineML:valveType xlink:title="Gate"/>
        <PipelineML:valveActuationTime uom="min">15</PipelineML:valveActuationTime>
        <PipelineML:valveNumber>V01274</PipelineML:valveNumber>
    </PipelineML:Valve>
</PMLDataset>
```

Sample Reference Data

ID	Code	Specification	Grade	Yield Strength	Bound Specification
DB55DD29-E754-48AC-A455-7F9D0A086194	0	No Data	No Data	NULL	No Data
8EF2D185-0C01-E811-80E8-38EAA735D691	6164	API-5L	A	30000	API-5L; A; 30000
8FF2D185-0C01-E811-80E8-38EAA735D691	6165	API-5L	A-25	25000	API-5L; A-25; 25000
90F2D185-0C01-E811-80E8-38EAA735D691	6166	API-5L	B	35000	API-5L; B; 35000
91F2D185-0C01-E811-80E8-38EAA735D691	6167	API-5L	X-42	42000	API-5L; X-42; 42000
92F2D185-0C01-E811-80E8-38EAA735D691	6168	API-5L	X-46	46000	API-5L; X-46; 46000
93F2D185-0C01-E811-80E8-38EAA735D691	6169	API-5L	X-52	52000	API-5L; X-52; 52000
94F2D185-0C01-E811-80E8-38EAA735D691	6170	API-5L	X-56	56000	API-5L; X-56; 56000
95F2D185-0C01-E811-80E8-38EAA735D691	6171	API-5L	X-60	60000	API-5L; X-60; 60000
96F2D185-0C01-E811-80E8-38EAA735D691	6172	API-5L	X-65	65000	API-5L; X-65; 65000
97F2D185-0C01-E811-80E8-38EAA735D691	6173	API-5L	X-70	70000	API-5L; X-70; 70000
98F2D185-0C01-E811-80E8-38EAA735D691	6174	ASTM A-106	A	30000	ASTM A-106; A; 30000
99F2D185-0C01-E811-80E8-38EAA735D691	6175	ASTM A-106	B	35000	ASTM A-106; B; 35000
9AF2D185-0C01-E811-80E8-38EAA735D691	6176	ASTM A-135	A	30000	ASTM A-135; A; 30000
9BF2D185-0C01-E811-80E8-38EAA735D691	6177	ASTM A-135	B	35000	ASTM A-135; B; 35000
9CF2D185-0C01-E811-80E8-38EAA735D691	6178	ASTM A-53	A	30000	ASTM A-53; A; 30000
9DF2D185-0C01-E811-80E8-38EAA735D691	6179	ASTM A-53	B	35000	ASTM A-53; B; 35000
9EF2D185-0C01-E811-80E8-38EAA735D691	6180	API-5LS	X-70	70000	API-5LS; X-70; 70000

Solving Real Business Needs

PipelineML was designed from the ground up to solve some critical business needs that have been lacking in the oil and gas industry. Of all its potential uses, the most critical is the ability for PipelineML to capture high-quality data when asset information is most readily available and then to propagate that information for the duration of the life of those assets. Toward this end, the original business use cases PipelineML was designed to address are as follows:
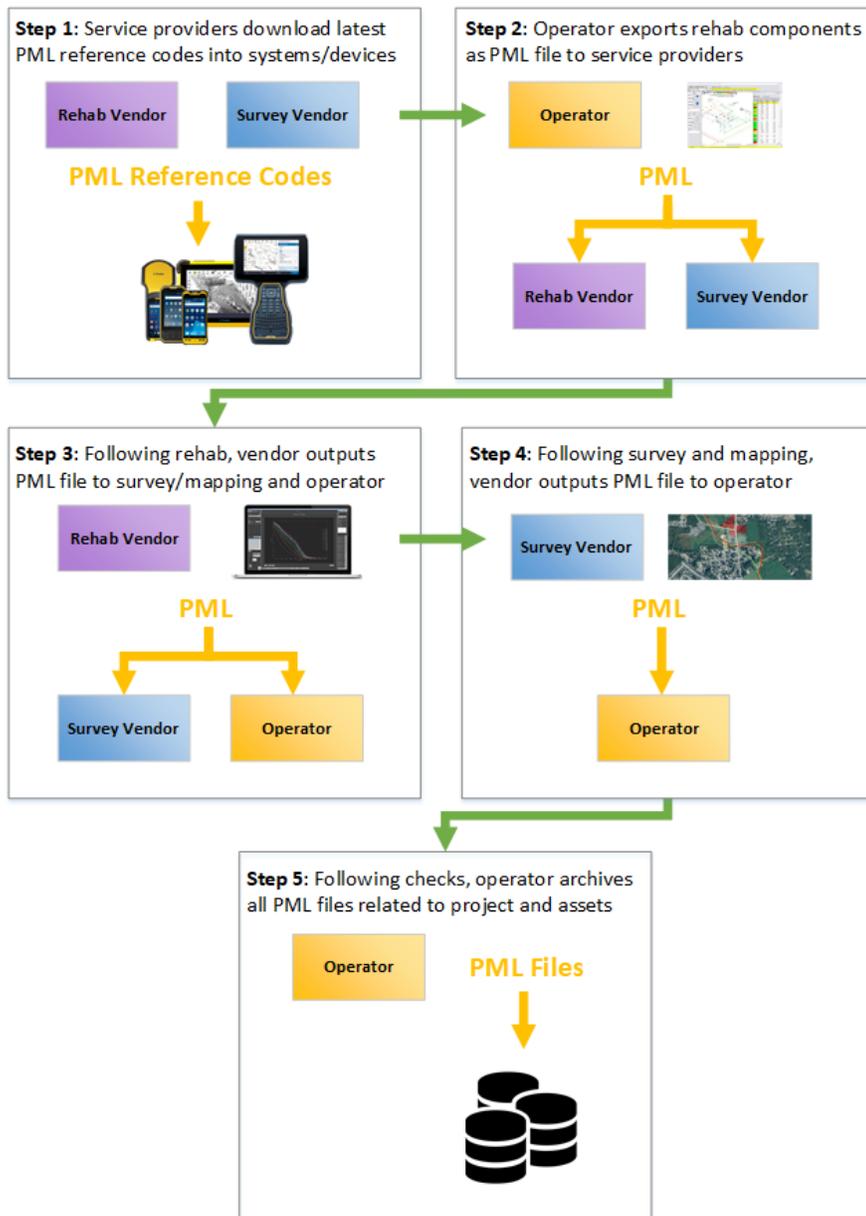
- New Pipeline Construction Projects Data Intake

- Pipeline Rehabilitation Projects Data Intake

- Asset Acquisitions and Divestitures

Pipeline Rehabilitation Use Case

The pipeline rehab use case illustrates its usefulness to both send and receive PipelineML information in the same business process. The following steps illustrate how PipelineML would be utilize to manage the entire process of getting information to and from rehab service providers:

Step 1: Operator requests service providers download the latest PipelineML industry standardized codes to use for the duration of the project. Service providers downloads the latest PipelineML codes and loads them into their construction management software and field collection devices.

Step 2: Operator uses their operational software to determine the section of pipe needing remediation. They output the inventory of affected components, their attributes, and weld location information into a PipelineML file. They run the PipelineML file through automated validation and finds no errors. They provide the PipelineML file to the rehab vendor as part of a digital dig package as well as to the survey and mapping company for review.

Step 3: The rehabilitation vendor uses the free PipelineML validation service to validate the incoming PipelineML file. They determine that it contains no errors. They import the PipelineML file into their construction management application. They use the component and weld location information to locate and verify the affected components. They perform the necessary remediation on the components and then output a PipelineML file containing all work completed. They validate it for accuracy and when no errors are found, they hand off a copy to the survey and mapping company as well as the operator.

Step 4: The survey and mapping vendor checks the PipelineML file by running it through the free PipelineML validation service and determines that it is valid and contains no errors. They complete the survey and mapping process and consolidate the results into their proprietary software in preparation for delivery. They export a PipelineML file from their internal software and then validate it to ensure it contains no warnings or errors. It passes. The survey and mapping vendor sends the file to operator.

Step 5: The operator receives the PipelineML file and runs it through the validation process where it passes all tests. They import the PipelineML file into their GIS software. They run a comparison between the incoming PipelineML file and the original outgoing PipelineML file and find no anomalies. They review the rehab work as well as the survey and mapping work and approve the results. The operator retains a copy of the initial outgoing PipelineML file, the rehab PipelineML file, and the survey and mapping PipelineML file in their project records repository (that contains metadata identifying the affected components and locations where it is discoverable by analytics engines in the future). The project is completed and closed.

Step 1: Service providers download latest PML reference codes into systems/devices

Rehab Vendor   Survey Vendor

PML Reference Codes

Step 2: Operator exports rehab components as PML file to service providers

Operator

PML

Rehab Vendor   Survey Vendor

Step 3: Following rehab, vendor outputs PML file to survey/mapping and operator

Rehab Vendor

PML

Survey Vendor   Operator

Step 4: Following survey and mapping, vendor outputs PML file to operator

Survey Vendor

PML

Operator

Step 5: Following checks, operator archives all PML files related to project and assets

Operator   **PML Files**

Built-in Data Quality Testing and Reporting

PipelineML includes a robust mechanism for testing and reporting the quality of the information contained in a PipelineML data package. Built into the current version of PipelineML (1.0) are 354 data rules against which every piece of data in a PipelineML file can be checked for compliance. If the data contained to a PipelineML file does not conform to any of these rules, warnings and errors can be generated that identify the source of data quality issues. This data quality testing capability translates into industry stakeholders having the tools they need to assess the quality of information that passes through their hands before they decide whether to accept it into their data holdings.

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Conclusion:

The careful considerations that went into the design of PipelineML that were subsequently tested through dozens of prototyping lifecycles provide a thoroughly vetted solution for enabling industry stakeholders to put information into the hands of decision-makers in a timely, cost-effective manner while maintaining a high pedigree of accuracy and data quality. This allows every business unit responsible for ensuring safe operations of assets to have the information they need to get business done. This results in such benefits as:

- The ability to discover asset information at the earliest possible state (when it is cheapest to discover) and then persist that information for the duration of asset life

- The means to significantly reduce the cost of information discovery

- The facility to get information into the hands of decision-makers faster and more reliably

- The mechanism to check the quality of data when it goes out and comes back so that issues can be discovered as quickly as possible before it has the opportunity to negatively impact operational decisions

- PipelineML provides a breadcrumb trail of asset information every time information trades hands that can be used in numerous processes such as TVC compliance

- A PipelineML file can be opened on any platform, software, version, or device (server, PC, Mac, tablet, or smartphone) today or 20 years in the future and its meaning will remain unchanged, providing a solid foundation for highly durable and available data persistent upon which sound business decisions can be made for decades into the future.

How to Start Using PipelineML

As an oil and gas stakeholder, all you need to do to begin leveraging the opportunities afforded by PipelineML is to contact your software vendor and ask them to build PipelineML data import and export capabilities into your software holdings. This will allow you to pull information into your internal systems from other parties as well as to get information out of your systems into the hands of other stakeholders who utilize other software products. For additional resources and information, visit PipelineML.org.

About the Author

Following studies in technology and computer programming in college, John Tisdale started his first software company in 1983. In the years that followed, he developed expertise as a data architect, designing complex data management systems using an assortment of technologies and standards. In the decades that followed, he designed solutions for a wide variety of technology clients including Microsoft, IBM, HP, 3Com, Dell, Cisco, and Novell, as well as numerous dotcom startups. Since the beginning of 2011, he has focused on architecting data management solutions for the oil and gas industry. John serves as the Co-chair of the OGC PipelineML Standards Working Group and has been instrumental in the development of PipelineML.